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ABSTRACT

As counterexamples to J. E. Grunig and J. B. Disbrow's probabilistic theory of communication behavior, which assumes that receivers have almost total control over communication behavior and that the only control possible for communicators is to limit communications to those publics most likely to be communicating with them, this paper cites instances when media coverage of seemingly irrelevant issues or advertising campaigns have themselves stimulated public communication. The paper then reformulates Grunig's multisystems theory of communication behavior as a set of simultaneous equations to explain these counterexamples. The presented equations conceptualize interactions among four independent variables--problem recognition, level of involvement, constraint recognition, and presence of a referent criterion--as well as the feedback effects of two dependent variables, information seeking and information processing, upon the independent variables. The paper contends that the model offers two possible means of entering the equation system to control audiences' communication behavior: through passive information processing and through actual involvement of the audiences in the situation. Finally, the paper uses the model to explain the "knowledge gap" and the necessary conditions for the agenda setting effect of the media. (FL)

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Theory & Methodology Division

A SIMULTANEOUS EQUATION MODEL FOR INTERVENTION IN COMMUNICATION BEHAVIOR

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A SIMULTANEOUS EQUATION MODEL FOR INTERVENTION IN COMMUNICATION BEHAVIOR

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ABSTRACT

The purpose of a theory is to explain how, in principle, some could intervene to control a phenomenon of interest to a researcher. For many years, communication scientists attempted to develop attitudinal theories designed to control the attitudes, knowledge, or behavior of audiences. More recently, researchers have attempted to develop theories which show how the communicator can control his own behavior to achieve communication accuracy or understanding. Grunig and Disbrow previously developed a probabilistic theory of communication behavior which assumed that the "receiver" has almost total control over his own communication behavior and that the only control possible for the communicator is to limit his communications to those publics most likely to be communicating with him. This paper points out counterexamples when media coverage of seemingly irrelevant issues or public relations or advertising campaigns have themselves stimulated further public communication about the issues. The paper then reformulates Grunig's multisystems theory of communication behavior as a set of simultaneous equations, which explains these counterexamples. The equations conceptualize interactions among the four independent variables: problem recognition, level of involvement, constraint recognition, and presence of a referent criterion. They also conceptualize feedback effects of two dependent variables, information seeking and information processing, upon the independent variables.

Both ordinary least squares (OLS) and two-stage least squares (2SLS) regression techniques are used. OLS estimates provided the best fit to the data because of low R^2s in the first stage of 2SLS and subsequent problems of multi-collinearity. In spite of the fact that OLS can result in biased and inconsistent estimates of the parameters of simultaneous equations, the results fit closely with the conceptualization of the theory. The paper concludes that the model offers two possible, although weak, means of entering the equation system to control the communication behavior of audiences; through passive information processing and by actually involving audiences in the situation of interest to the communicator. The regression results showed that in most instances audiences actively communicate, as uses and gratifications theorist assert. But they also show that at times information may be processed randomly. That is , the audience is passive and does not exert control over its communication behavior. Finally, the paper uses the simultaneous equation model to explain the "knowledge gap" and the necessary conditions for the agenda setting effect of the media.

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A SIMULTANEOUS EQUATION MODEL FOR INTERVENTION IN COMMUNICATION BEHAVIOR

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A good theory, according to Meehan (1968: 46), should provide understanding of why a phenomenon has occurred in the past, generate expectations of when and how it will occur in the future, and suggest how, in principle, one can intervene to alter or control the phenomenon. Meehan stresses the words "in principle" when explaining control, because technology may not be available at any particular time to make actual control possible (p. 21). In common research language, control means that altering the state of the independent variables, would, in principle, alter the dependent variables in a way predicted by the theory.

In early communication research (Kline, 1972), researchers treated communication variables as independent variables and attempted to develop theories which would afford control over such dependent variables as attitudes, knowledge, or behavior. Recently, however, researchers have treated communication variables--especially communication behaviors--as dependent variables which can be explained and therefore controlled by other variables.

Interactional models (Fisher, 1978: 173) or coorientational models (McLeod and Chaffee, 1973) suggest two points of control in a communication relationship: control of the communication behavior of the person, organization, or other human system which traditionally has been labeled the "source" and control of the communication behavior of the traditional "receiver." (It should be clear, however, that in an interactional model, each of the two communicating systems will oscillate between being the source and the receiver.) For two individuals communicating interpersonally theories can explain how both persons can work cooperatively and thus jointly control their communication behaviors (see, e.g., Miller, Nunnally, and Wackman, 1975). However, communication professionals in such fields as journalism, public relations, advertising, or information science, seldom have the opportunity to personally

iinteract with the publics they are paid to communicate with in order to jointly control their communication behaviors.[2] The communication professional, therefore, generally can improve communication with a public more by exerting control over his own behavior than by attempting to exert control over the behavior of his publics.

For this reason, Grunig and Disbrow (1977) developed a decision making model which would help a professional communicator successfully communicate with publics by predicting which publics are most likely to have high probability of communicating with him. We described the rationale of that model as follows (p. 147):

> Our objective here is to use probability theory to quantify the expectations of the communication manager who must decide to whom, if anyone, to disseminate information. Given that a manager could approve giving information on a topic, issue or problem to any number of different kinds of people, our objective is to develop a theory that would identify those people most likely to use that information. With a set of probabilities expressing the likelihood of communicating with several alternative publics, the manager should be able to complete the decision process by applying resources to those publics most likely to be communicating with him, then to the publics next most likely to be communicating, and so on until his resources are exhausted.

In developing this probabilistic model, we argued essentially that the "receiver" of a communication professional's messages has almost total control over his own communication behavior and that the only control possible for the professional is to limit his attempts to communicate to those publics most likely to be communicating with him. The theory which the probabilistic model depicted consists of four variables describing a person's perception of a situation and two communication variables which can be predicted by different combinations of the situational perception variables. Because the communication professional can control only the messages which are the object of a person's communication behavior and cannot control the situational perceptions which precede communication behavior, it followed that the professional could not control the extent to which members of a public would use the messages directed at them.

A simple example illustrates this logic. I once described research to an

English Professor friend which had showed that people would not seek information which they did not perceive to be relevant (Grunig, 1974; Atkin, 1973). "But couldn't you write something so well that a person would see the relevance of the information?" he asked. "Not if he doesn't read what you've written," I replied.

As logical as this reasoning might seem, one can think of many counterexamples when media coverage of seemingly irrelevant issues or public relations or advertising campaigns have aroused public concern and resulted in further communication about the issue. Rachel Carson's Silent Spring and the resulting environmental concern, and media coverage of civil rights issues are two such examples.

Krugman and Hartley's (1970) discussion of passive learning from television suggests a difference between passive communication behavior and active communication behavior which makes it possible to revise the theory to explain these anomalies. Passive communication behavior depends less on the relevance of information to a person's perceived situation than does active communication behavior. As a result, a person might passively process information which might change his perception of the situation which, in turn, might stimulate active communication behavior. Because the communication professional can increase the flow of messages processed passively, he might be able to gain some control over the communication behavior of the publics in his audience. If that were the case, he might be able both to intervene in his own and in his public's communication behaviors to better control the effects of their joint communication.

The purpose of the research reported here was to reformulate Grunig's (1975) multisystem's theory of communication behavior as an intervention model rather than as a probabilistic, adaptation model. Doing so should make the theory a better explanation of reality. The reformulation should also make the theory a more powerful instrument for the communication manager who would have an explanation of how he could communicate to increase the likelihood that a public would make use of his communications.

CONCEPTUALIZATION OF A SIMULTANEOUS EQUATION MODEL

Grunig's multisystems theory provides a situational explanation of communication behavior, as opposed to the cross-situational explanation provided by attitude theory.[3] The theory does not assume that the situation alone can explain a person's communication behavior. Rather, it assumes that how a person perceives a situation can explain when and how he will communicate about that situation. The theory assumes that each person will attempt to cope with a situation in a way that he perceives will work best in that situation. He will seek information when it has utility for a situation. He may use an old attitude in situations where it will work and develop a new one when the old attitude no longer fits the situation. The multisystems theory consists of two dependent variables, which are types of communication behaviors, and four independent variables, which are perceptions of the situation.

The two communication variables are called information seeking and information processing. Information seeking is an active communication behavior. A person deliberately seeks information which has utility for him when he must plan a behavior in a specific situation. Information processing, on the other hand, is passive (Krugman, 1965; Krugman and Hartley, 1970). A person does not look for and does not generally need information which he processes. He may take in--process--information which comes to him from the media or another person at a time when he is not actively involved in decision making or information seeking. Watching television advertisements, reading a magazine while waiting for a medical appointment, reading about events in foreign countries, or listening to the radio while driving are all examples of information processing. The four independent variables explain: 1) the frequency with which communication behavior occurs and 2) the situations in which information processing will occur but in which information seeking will not.

The first of the independent variables, problem recognition, represents the

extent to which a person recognizes that something is missing or indeterminant in a situation so that he stops to think about the situation. Generally, when a person perceives a situation as problematic, he inquires about the situation (Dewey, 1938). Thus, problem recognition increases the probability that a person will communicate about a situation.

The second concept, constraint recognition, represents the extent to which a person perceives constraints in a situation which limit his freedom to construct his own behavior. If a person realizes that his freedom to move in a situation is limited, information which helps him to understand alternative movements has little relevance and the probability that he will communicate is reduced.

The combination of these two concepts can be interpreted as four types of perceived situations. The behaviors resulting from these perceived situations have been called problem-facing behavior (high problem recognition, low constraint recognition), constrained behavior (high problem recognition, high constraint recognition), routine behavior (low problem recognition, low constraint recognition), and fatalistic behavior (low problem recognition, high constraint recognition).

For each of these perceived situations, the person may also have available a referent criterion from another situation, the third variable in the theory. A person has a referent criterion when he has a cross-situational "attitude" which tells him what to do in a situation. Thus, the referent criterion is a situational reformulation of the concept of an attitude. Attitude theory assumes that the cross-situational attitude will lead to a specific behavior consistent with the attitude in a specific situation. The multi-system theory, in contrast, conceptualizes the referent criterion as a guide or rule learned in previous situations which the person uses with discretion in a new situation. In a new situation, the person may apply the referent criterion as an initial guide for resolving the situation. If the old criterion seems to fit the situation, the

person will use it to guide his behavior. If it does not seem to work he will develop a new solution--a new criterion--to guide his behavior in the new situation.

In addition to its relationship to other behaviors in a situation, a referent criterion also influences a person's communication behavior in that situation. The referent criterion subsumes what a person has learned in previous, related situations and thus reduces his need for new information to deal with a new situation. Recent research by Grunig and Stamm (1979) and Stamm and Grunig (1977) has shown, however, that a person is most likely to have a referent criterion when problem recognition and level of involvement are high and constraint recognition is low. As a result, the presence of a referent criterion may be associated with communication, and this positive correlation may cancel out the hypothesized negative correlation with communication behavior.

Whereas the first three independent variables of the theory explain why a person communicates or does not communicate, the fourth explains whether his communication behavior will be active information seeking or passive information processing. A person's perceived level of involvement is defined as the extent to which the person connects himself with objects in the situation. When a person perceives himself as involved in a situation, he actively seeks information because his own behavior is involved and he needs information to help design and control that behavior. When involvement is low, however, a person will not be likely to seek information, although he will passively process information if it comes to him without much effort on his part.

Combining these four situational variables results in a typology of 16 kinds of perceived situations and their accompanying communication behaviors, a typology which closely resemble publics as conceptualized by Dewey (1927) and Blumer (1946). These 16 combinations also were the conditions for which Grunig and Disbrow (1977) computed conditional probabilities of information seeking and processing.

As described thus far, the situational theory can be modeled as two recursive equations--recursive meaning that the situational variables affect the communication variables but that the communication variables do not affect the situational varables:

$$IS_1 = a_1 + b_{11}P_i + b_{12}I_i - b_{13}C_i - b_{14}R_i + E_{1i} \quad (1)$$

$$IP_1 = a_2 + b_{21}P_i - b_{22}C_i - b_{23}R_i + E_{2i} \quad (2)$$

in which IS_i = information seeking
IP_i = information processing
P_i = problem recognition
I_i = level of involvement
C_i = constraint recognition
R_i = presence of referent criterion
a_i = the Y intercepts
b_{ii} = the regression coefficients
E_{ii} = the error terms

As formulated, this set of two equations overlooks the possibility, discussed above, that there may be a nonrecursive relationship between the independent and dependent variables; that is, the communication variables may have a "feedback" effect upon the situational perception variables. Similarly, several previous studies have found strong correlations (generally in the .50 range) between the four situational variables. Thus, several logical interrelationships between the six variables of the theory do not seem to be adequately modeled by the two recursive equations and would seem to be more accurately described by a simultaneous equation model.

In a set of simultaneous equations, variables [illegible] which are independent variables in one equation may be dependent variables in another equation (see, e.g., Pindyck and Rubenfeld, 1976; Heise, 1975). Thus, a change in the value of a variable anywhere in one equation will have a ripple effect throughout the system of equations. Because of the interactions between "independent" and "dependent" variables, statisticians refer to the variables in a set of simultaneous equations as exogenous and endogenous variables. The values of exogenous variables are predetermined outside the system. The values of endogenous variables

are explained, at least in part, by variables within the system.

Using the premises of the multisystems theory and research related to the theory, the theory can be specified by the following set of simultaneous equations (in which the symbols have the same meaning as in the two-equation model):

$$IS_i = a_1 + b_{11}P_i + b_{12}I_i - b_{13}C_i - b_{14}R_i + E_{1i} \quad (1)$$

$$IP_i = a_2 + b_{21}P_i - b_{22}C_i - b_{23}R_i + E_{21} \quad (2)$$

$$P_i = a_3 + b_{31}I_i - b_{32}C_i + b_{33}IP_i + b_{34}IS_i + E_{31} \quad (3)$$

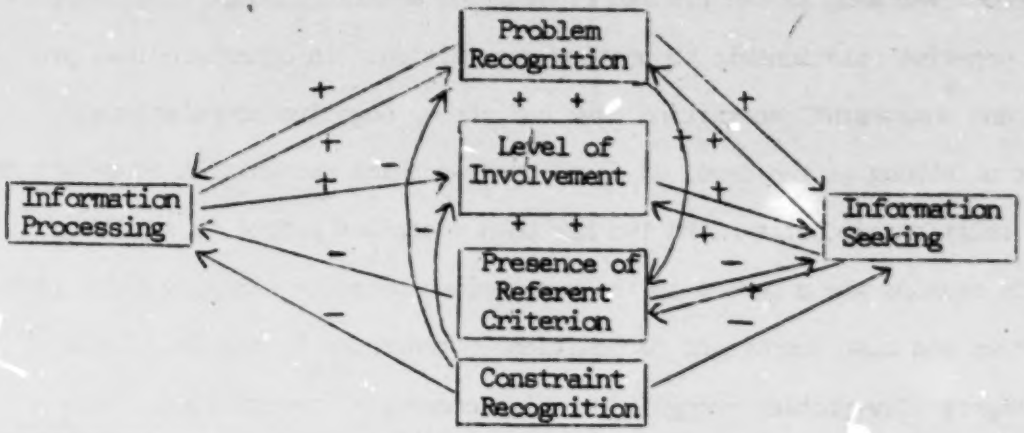
$$I_i = a_4 + b_{41}P_i - b_{42}C_i + b_{43}R_i + b_{44}IP_i + b_{45}IS_i + E_{4i} \quad (4)$$

$$R_i = a_5 + b_{51}P_i + b_{52}I_i + b_{53}IS_i + E_{5i} \quad (5)$$

Because all variables but one in this system (constraint recognition) are endogenous variables, the system is underidentified and cannot be solved (Pindyck and Rubinfeld, 1976; 139-143; Asher, 1976: 49-61). To be underidentified means that not enough information is available from outside the system to make it possible to calculate a single value for each coefficient in the system.. Some of equations in a system can be identified and others may not. A necessary, but not sufficient, condition for identification is that the number of exogenous variables excluded from an equation must be greater than or equal to the number of endogenous variables on the right side of the equation. None of Equations 1-5 are identified, and additional variables must be added to the system if estimates are to be made for the regression coefficients. The model can be examined as is, however, to conceptualize the relationships among the multisystems variables. Doing so may be easier if the interrelationships in Equations 1-5 are depicted as a causal model (Figure 1). Each of the five equations can thus be conceptualized in turn.

FIGURE 1

A Causal Model of the Multisystems Theory



Equations 1 and 2 specify all of the relations depicted by arrows pointing to information seeking and information processing in Figure 1. These two equations are identical to the equations in the two-variable recursive model and are numbered the same. In Equation 1, information seeking increases with increases in problem recognition and level of involvement and decreases with an increase in constraint recognition and the presence of a referent criterion. Level of involvement does not enter into the information processing equation. In equation 2, information processing increases with an increase in problem recognition and decreases with an increase in constraint recognition and presence of a referent criterion. Level of involvement does not enter into the information processing equation. These equations specify the original conceptualization of the multisystems theory, which have been supported many times, and thus need no additional explanation here.

The problem recognition equation, Equation 3, indicates how the other variables that were independent variables in the recursive model interact with problem recognition and the reciprocal effect of the two communication variables upon problem recognition. Equation 3 shows first that problem recognition increases with level of involvement. These two variables have consistently correlated in the .50 range in other studies, and they also have a logical relationship. Generally, a person will recognize fewer problems in situations which do not involve him because an involving situation, in a sense, forces itself upon a person. If the situation does not involve a person, the problem is someone else's problem, and few

people recognize things missing in someone else's situation as often as they do in their own.

The second variable in the problem recognition equation, constraint recognition, has a negative relationship to problem recognition. In other studies, problem recognition and constraint recognition have had strong negative correlations, although not as strong as the level of involvement-problem recognition correlations. The logical relationship between the two has been described before (e.g., Grunig, 1976a) as the reasons why a person in the constrained behavior category (high problem recognition and high constraint recognition) often moves to the fatalistic behavior category (low problem recognition, high constraint recognition. When a person realizes that he cannot do anything about a situation which he recognizes as problematic, eventually he gives into the constraints and stops recognizing the situation as problematic--that is, he becomes fatalistic about the situation. Thus, constraint recognition may lower problem recognition.

The last two relationships in Equation 3 indicate that information seeking and processing may have a reciprocal effect upon problem recognition. Learning more about a situation, through either type of communication, may make it more likely that a person will know of disorder--something missing--in a situation. Information seeking and processing themselves occur as a function of other variables in the system, and, therefore, may not have a positive effect upon problem recognition unless other variables first act upon them. At this point, in other words, we do not know which comes first, problem recognition or communication behavior.

Equation 4 specifies a similar set of relationships between level of involvement and four other variables. Involvement may increase problem recognition, but problem recognition may also increase involvement. That effect could occur when someone recognizes a problem and, as a result, chooses to become involved in the situation (see Grunig, 1976a: 262 for an empirical example). Similarly, a person often will choose not to become involved in a situation if he perceives there is

nothing he can do about the situation (high constraint recognition). The referent criterion contributes to involvement because, by definition, it is a prescription for action in a specific situation. If a person knows what to do about something, he is more likely to get involved than if he does not know what to do. Finally, information seeking and processing may lead directly to higher involvement, just as they may lead directly to higher problem recognition. Comparing Equations 3 and 4 also shows that the two communication behaviors may indirectly lead to higher involvement via the path which leads through problem recognition to level of involvement.

The referent criterion equation, Equation 5, follows directly from the assumption that referent criteria are formed out of experience and from accumulated information. People most often develop solutions for situations with which they have experience (been involved with) (see Stamm and Grunig, 1977; Grunig and Stamm, 1979), when problem recognition arouses their interest, and when they have sought information which can be used to form attitudes (Saltiel and Woelfel, 1975).

Constraint recognition is specified as an exogenous variable in this system of equations. Constraint recognition begins with actual constraints in the situation. Some people are more likely to see these constraints than others, however, and additional variables will be added to the system below to attempt to account for these individual differences.

The next step in the development of this simultaneous equation model is to add exogenous variables to the system so that each equation will be identified. Variables added may differ as the multisystems variables are applied to different types of situations in different studies. The model was developed here with variables used in two studies of publics for environmental communication programs (Grunig, 1978b) and in a study of corporate economic education programs for journalism students (Grunig, 1979a). These variables included demographic variables which correlate with the situational variables (Grunig, 1977: 52), variables indicating actual involvement in either environmental situations (hiking, swimming, camping, commuting, hunting, fishing, and biking) or economic situations (majoring in business or economics, taking business courses,

owning stock), attitude scales that might be related to having a referent criterion, measures of actual exposure to news items and publications, and a measure of membership in environmental organizations.

Of the new variables, all were treated as exogenous variables with the exception of news exposure, knowledge, and organizational membership. These new endogenous variables, therefore, each required a new equation. The new variables added to Equations 1-5 were the following:

Equation 1 (Problem Recognition): Readership of Business Publications, Readership of the Newspaper Financial Page (both in the economic study only).

Equation 2 (Information Processing): Readership of Business Publications, Readership of the Newspaper Financial Page (both in the economic study only).

Equation 3 (Problem Recognition): Education (in both environmental studies), Parent Education and Grade Point Average (as an equivalent to education for the university students in the economic study), Race (in both studies), and Income (in the environmental studies only).

Equation 4 (Level of Involvement): Age (in both environmental studies, because young people supposedly are more involved); Hiking, Camping (in both environmental studies); Swimming, Commuting, Hunting and Fishing as one variable (in the first environmental study); Hunting, Fishing (in the second environmental study); Number of Business and Economics Courses, Business Major, Public Relations Major, Self or Parent Ownership of Corporate Stock (in the economic study).

Equation 5 (Referent Criterion): Knowledge (all studies); News Exposure (economic study); Environmentalist Attitude, Willingness to Pay More Taxes to Clean up Environment (second environmental study); Pro-Business Attitude, Pro-Government Attitude, Liberal Political Philosophy, Republican Party Affiliation (economic study).

With these variables, it became possible to treat constraint recognition as an additional endogenous variable, as specified by Equation 6:

$$C_1 = a_6 - b_{61}ORG_i + b_{62}INC_i + b_{63}MALE_i + b_{64}AGE_i + E_{6i} \qquad (6)$$

in which: C_i = Constraint recognition

ORG_i = Organization Membership

INC_i = Income

$MALE_i$ = Male Sex

AGE_i = Age

The organizational membership variable has special importance because it indicates that people who belong to an interest group formed to deal with a problem will perceive fewer constraints.

The organization should give them a means to eliminate the constraints and thus lower their perception of constraints (see Grunig, 1976b for empirical evidence). The organizational variable, however, was measured only in the first environmental study.

Membership in environmental organizations was treated as an endogenous variable under the assumption that the four situational variables are related to actions--behaviors other than communication--much as they are related to thought and communication (Grunig and Stamm, 1979). That is, the four variables provide necessary conditions for a person to consider a situation, communicate about it, develop an attitude to resolve the situation, and do something to resolve the situation. Thus, membership in organizations, one type of action that a person could take to resolve a situation, should have a positive relationship with problem recognition, level of involvement, and presence of a referent criterion. Because group actions generally are more effective than individual actions when constraints are present, membership in organizations should also have a positive relation to constraint recognition. For the first environmental study, therefore, Equation 7 could be added to the system:

$$ORG_i = a_7 + b_{71}P_i + b_{72}I_i + b_{73}R_i + b_{74}C_i + E_{7i} \qquad (7)$$

in which ORG_i = membership in related organizations and the other symbols are used as in previous equations.

Two variables which represent effects of communication behavior were measured in one or more of the three studies and can be used to enrich the equation system. The questions used to measure information seeking and processing were hypothetical questions which asked respondents how likely they would be to seek out a brochure after they were told its title or how likely they would be to pay attention or to--process--a newspaper or television news lead. The

two communication effects variables, general knowledge of environmental issues or economic principles and short-term exposure to economic news, should indicate whether these hypothetical measures of communication behavior correlate with actual exposure to or knowledge of information which the hypothetical variables would predict people will seek or process in actual experience.

Both effects variables were treated as endogenous variables which can be explained by the short term communication variables and, in the case of knowledge, by education-related and income variables. Because they were endogenous variables, a new equation was necessary for both exposure and knowledge. Equation 8, for exposure, was:

$$EXPOS_i = a_8 + b_{81}IS_i + b_{82}IP_i + b_{83}BPUB_i + b_{84}FPAGE_i + E_{8i} \quad (8)$$

in which $EXPOS_i$ = News exposure
$BPUB_i$ = Readership of business publications
$FPAGE_i$ = Readership of newspaper financial page

and the other symbols are used as before.

The equations for knowledge were similar in the two studies. Because slightly different variables were measured in the environmental and economic studies Equation 9a is specified for the environmental studies and 9b for the economic study:

$$KNOWL_i = a_9 + b_{91}IS_i + b_{92}IP_i + b_{93}EDUC_i + b_{94}INC_i + E_{9i} \quad (9a)$$

$$KNOWL_i = a_9 + b_{91}IS_i + b_{92}IP_i + b_{93}GPA + b_{94}PEDUC_i + b_{95}BEC_i + E_{9i} \quad (9b)$$

in which $KNOWL_i$ = Knowledge
$EDUC_i$ = Education
INC_i = Income
GPA_i = Grade Point Average
$PEDUC_i$ = Parent Education
BEC_i = Business/Economics Courses

and the other symbols are used as before.

One should also note that both of these effects variables enter into the referent criterion equation above, because a person must know something about a situation before he can construct an attitude about that situation.

In total, then, the multisystems theory has been specified as a system with nine endogenous variables and nine equations. The four situational perception variables have been conceptualized as being a function of the other situational variables, several demographic and attitudinal variables, and variables indicating actual exposure in the situations studied. Communication behavior has been conceptualized as a function of the situational variables and some readership variables which should correlate with communication behavior. Two effects of communication behavior, exposure and knowledge, and one actual behavior, joining of relevant organizations, also have been conceptualized as being a function of the situational variables.

Of these nine equations, the level of involvement equations for the environmental studies have the same number of exogenous variables excluded from the equation as the number of endogenous variables included on the right-hand side of the equation. Thus, these two equations are exactly identified. All other equations have more exogenous variables excluded than endogenous variables on the right-hand side of the equation. Thus, these two equations are exactly identified. All other equations have more exogenous variables excluded than endogenous variables on the right-hand side of the equation. Thus, they are overidentified. As none of the equations are underidentified the parameters of all equations can be estimated using regression techniques.

Economists construct simultaneous equation models as a means of forecasting the value of one or more variables after a change in one or more other variables of the system. For example, the price of oil might be one variable in the system. If the price of oil rose, that change would have a ripple effect throughout the system which might, for example, eventually increase the price of bread. The communication professional might use the system constructed here in the same way. His objective might be to increase the level of communication behavior (information seeking or processing), one of the communication effects (exposure or knowledge), or an actual

behavior (such as joining an organization). All of these variables derive their values largely from the four situational variables, so the communicator might ask how he might change these variables if their current values discourage communication behavior, communication effects, or behavior.

Examining the system indicates that the four variables might change with education, actual involvement of the person in a situation, change of long-term attitudes, or by information processing. Other demographic variables, such as age or income, seldom can be controlled by a communicator. Of these variables, only information processing offers much hope to the communicator, as the others change only slowly over time. Thus, as discussed above, we can examine the equations--after parameters have been estimated--to see if a change in information processing will result in a ripple effect throughout the system that will provide control over one of the variables of concern to the communicator. The only other means of control offered by the model might be actual involvement of people in situations important to the communicator. For example, an environmental advocate might try to get people to experience pollution or the advertiser might try to involve people with his product through free samples or similar techniques.

As constructed here, the simultaneous equation model seems to advance the multisystems theory from a probabilistic model which offers control only over the behavior of the communicator to a intervention model which offers control over the behavior of both the communicator and the publics in his audience. The model seems theoretically reasonable, and it seems to confirm experience of communication professionals. The next step, therefore, is to subject the model to empirical test to see if it can be supported by data.

METHODOLOGY

Parameters of a system of simultaneous equations systems can be estimated using single-equation regression methods or multi-equation methods (Pindyck and Rubinfeld, 1976). The multi-equation methods estimate all parameters of the

equation simultaneously, the single-equation methods estimate the parameters of only one equation at a time. Generally, the multi-equation methods do not increase the accuracy of forecasting enough to justify their greater cost of computation (Pindyck and Rubinfeld, 1976: 290).

The ordinary least squares method (OLS) generally should not be used to estimate values of coefficients in single equations of a system, because simultaneous equations violate the assumption that a variable on the right-hand side of an equation cannot be correlated with the error term. The endogenous variables of an equation will be correlated with the error terms in other equations in which they appear on the left-hand side of the equation. Because each equation affects every other equation in the system, the endogenous variables will be correlated with the error term in equations in which they are right-hand variables. As a result, OLS results in biased and inconsistent parameter estimates. An estimate will be biased when the value reached does not converge upon the true population value as sample size increases. It will be inconsistent if the procedure does not consistently arrive at the same value as sample size increases. As a result, OLS estimates have a high standard error (root mean square error), which means that the values which the parameters predict for each observation of the left-hand variables can differ substantially from the true observed values.

The problem of a high standard error can be avoided if an "instrumental" variable can be found which correlates highly with an endogenous variable and is substituted for the endogenous variable whenever it appears on the right-hand side of an equation. Because the instrumental variable will not be correlated with any error terms in other equations, it will not violate the assumptions of OLS, and OLS can then be used to estimate the values of the parameters.

The most common way of estimating instrumental variables is two-stage least squares (2SLS). The first stage of 2SLS consists of regressing each endogenous variable upon all exogenous variables. The values which the resulting regression

equation predict for the endogenous variable (the Y' values) then serve as the observations of instrumental variables substituted for the endogenous variable. In the second stage of 2SLS, these instrumental variables are substituted for the endogenous variables whenever they appear on the right-hand side of the equation, so that OLS estimates can be computed. Because the exogenous variables will not be correlated with any error terms in the system use of these instrumental variables will not violate the assumptions, although 2SLS estimates will still be biased (Pindyck and Rubinfeld, 1976: 287).

For 2SLS to be used successfully, however, the instrumental variables calculated in the first stage must be highly correlated with the actual variables, generally with a R^2 of .80 or above. Although R^2s of that size may often be found in economics, they are seldom found in other behavioral sciences (e.g., Cohen, 1977: 414 defines an R^2 of .26 as a large effect size for behavioral research). As will be explained below, R^2s computed in this study were large by Cohen's standards but not by the standards assumed for 2SLS. Low correlations of the instrumental variables with the actual variables caused problems in calculating second-stage parameters. Thus, OLS estimates were also calculated and compared with the 2SLS estimates because, according to Pindyck and Rubinfeld, (1976: 287), OLS may conceivably be more suitable than 2SLS if OLS results in a lower standard error.

The data fit to the set of simultaneous equations came from two studies of environmental communication (Grunig, 1978b) and a study of corporate economic education programs for journalism students (Grunig, 1979b).

National samples were developed for the environmental studies using a combination of purposive and random methods. The first sample was of urban areas. Interview locations were chosen purposely: Washington, Baltimore, Chicago, Cleveland, and University of Maryland students and physical scientists. Respondents from each location were chosen through random digit dialing. The second sample consisted of respondents from nine purposively chosen rural communities, five in

Maryland, two in Missouri, and two in the state of Washington. Respondents again were chosen through random digit dialing in each of these communities. Although these samples cannot be generalized to the national population, they do represent a range of conditions under which the multisystems theory may apply and should provide a legitimate test of the theory. Sample size in the first study was 231, and 225 in the second.

The sample for the economic study was designed to represent the population of journalism and business students at the University of Maryland (the purpose of the study was to determine if journalism and business students would fall into different publics with different communication behaviors, attitudes toward business, and knowledge of economics). To develop the sample, courses were chosen from the College of Business and Management and the College of Journalism which were required of all majors. All students in these courses then completed questionnaires during a class period. Sample size for this study was 293.

The four situational perception variables were measured with questions developed over several studies (Grunig and Disbrow, 1977; Grunig, 1978b; Grunig 1979a; Grunig, 1979b). The wording was slightly different in each study, but there is no reason to believe those changes affected the outcome of the regression analysis. The measures of information seeking and processing had also been developed over several studies. To measure information seeking, respondents were given titles of brochures or booklets and asked how likely they would be to send for the information. To measure information processing they were given leads of newspaper or television news stories and asked how likely they would be to read on or to pay attention to the rest of the story (information processing). These six variables were measured for eight different situations in the environmental studies and nine situations in the economic study. For example, for level of involvement respondents were asked whether they perceived a strong, moderate, weak or no connection with such situations as the energy crisis, air pollution, the extinction

of whales, business profits, or taxation of business. The communication variables were measured by giving respondents hypothetical titles of brochures and news stories for each of the same situation.

In each study, responses to the different situations were factor analyzed for each variable to reduce the number of situations to those which brought similar responses from the same respondents. In each environmental study, one major emerged but three situations did not load highly on this factor for each of the six variables. In subsequent analyses scores for the situations loading highly on the single factor were added into a new general environmental variable, and the other three situations were treated as separate variables. Two factors resulted in the economic study. Those situations directly relevant to people--pollution, prices of products, and quality of products--loaded highly on the first factor for each variable. Less relevant situations--such as free enterprise, taxation of business, or corporate profits--loaded on the second factor for each variable.

For the regression analyses in this article, the "general environmental" variable from the environmental studies and the factor scores from both factors in the economic study were used as measures of the multisystems variables. As a result, four separate, and comparative, analyses could be made for each of the equations in the system.

Other variables in the regression analysis were measured through Likert-type scales. The exposure and knowledge variables were computed by giving respondents five true-false questions and adding the number of correct answers. Membership in environmental organizations was computed by asking respondents to name organizations to which they belonged and using the number named as a measure of the variable. All variables, therefore, were measured on an ordinal or interval scale and met the scaling assumptions of regression analysis.

RESULTS

Table 1 presents the results of the first stage of two-stage least squares, the regression of the endogenous variables on the endogenous variables to create instrumental variables. This table shows that, although moderate to high by behavioral science standards, these R_2 values do not approach the high levels which econometricians suggest for 2SLS. The values are notably low for the second factor in the economic study. Because of these low R_2 values for the first stage of 2SLS, OLS estimates were also made for each equation. The R_2 values, the F-ratios, and the standard errors of the two regression equations then were compared to see which method resulted in the better goodness of fit.

In general, the OLS estimates best met two criteria suggested by Pindyck and Rubinfeld (1976: 315): 1) statistical significance and 2) the theoretical reasonableness of each equation. But because of the inconsistency of OLS estimates, one should exercise caution in using the parameters estimated to predict a future state of a given variable. However, it does seem reasonable to use the estimated parameters for model building and explanation, to see if the values meet our theoretical predictions. Pindyck and Rubinfeld, (1976: 315) say, for example, that a model designed for forecasting should have a small standard error of forecast, while a model designed to test a specific hypothesis should have high significance levels for the regression coefficients. In almost every case here, the coefficients were significant for the OLS estimates but not for the 2SLS estimates.

2SLS estimates were generally not statistically significant because of high degrees of collinearity in the second stage equations. Most of the correlations between the instrumental variables were much higher than the correlations between the original variables (Table 2). Multicollinearity inflates the variance of regression estimates, thus reducing their likelihood of being statistically significant. When two predictor variables are highly correlated, the coefficient of one may be low when it should be high and may even have the opposite sign of what it

should be. These problems were evident for the 2SLS estimates in this study, especially when several endogenous variables were included in one equation. When only a few endogenous variables were included in an equation, 2SLS and OLS extimates were nearly identical.

With these statistical problems in mind, we can look at the regression results on an equation-by-equation basis and compare them with the theoretical predictions.

Information Seeking. Table 3 shows that the OLS estimates for the information seeking equation generally have higher R_2s, lower standard errors, and higher F ratios than the 2SLS estimates. With a few exceptions, however, the parameter estimates are quite similar for the two methods. The exceptions are problem recognition for the second environmental study and the first economic factors, level of involvement for the first economic study and the second economic factors, constraint recognition for the second economic factors, and referent criterion for the first economic factors. In these cases, multicollinearity seems to have reduced the size, or changed the sign of the regression coefficient.

Otherwise, the reuslts are consistent with the equation as conceptualized and reasonably consistent across studies. The major difference from what was expected was a smaller contribution from level of involvement, especially in the economic study. If these Betas are accurate, it would probably mean that level of involvement has its major effect upon information seeking indirectly through problem recognition rather than directly. The referent criterion estimates are low and inconsistent, no doubt because of the opposite relationships with information seeking that were described above. The presence of a referent criterion directly reduces the need for information also correlates with the other situational variables which increase information seeking. A reasonable conclusion is that a referent criterion is more determined by the other situational variables than it determines information seeking.

Information Processing. The R_2, F, and standard error values in Table 4 show that OLS also provided better regression estimates for this equation than does 2SLS. The two estimates of Betas are close, however, except for a few instances in which the value computed in 2SLS drops or changes sign from the OLS estimate, as often happens when multicollinearity is present.

The results again fit closely with the conceptualization of the theory. Problem recognition and constraint recognition predict information processing in the expected directions. The Betas calculated here for information processing are lower than they were for information seeking. If those estimates are accurate, they would indicate that information processing depends less upon the situational variables than does information seeking. Thus, as conceptualized, information processing does appear to occur randomly at time.

Problem Recognition. Table 5 shows that 2SLS provides consistently poorer estimates of the regression coefficients than OLS. The three measures of goodness of fit are consistently poorer, and the Beta weights are either low, inconsistent across studies, or in the opposite direction of that expected. The OLS estimates, in contrast, fit the theory well. Level of involvement is the strongest predictor of problem recognition. Constraint recognition has a fairly consistent, although lower, negative relationship to problem recognition.

Information processing and seeking have special significance here because of the possibility that they may act upon themselves indirectly through problem recognition. Table 5 shows that both have consistently positive Betas although these coefficients are usually small and not always consistent.

Important also is the fact that with the exception of education in the economic study the demographic variables are poor predictors. In that study, environmental researchers and university students had been purposively oversampled. Thus the correlation between problem recognition and education probably [illegible]

was spurious because these respondents would be likely to recognize environmental problems and also have high levels of education.

Level of Involvement. For this equation also, 2SLS resulted in a poor fit of the data and obvious problems of multicollinearity. With the exception of a few values in Table 6, however, the OLS estimates confirm the conceptualization of the model. People are more likely to perceive an involvement in a situation if they recognize a problem in the situation, have a referent criterion to suggest how to become involved, and do not perceive constraints.

The regression coefficients for information seeking and processing generally are small and sometimes negative. The larger coefficients, however, are positive and suggest that if OLS were to provide consistent estimates that these two communication variables would have a small reciprocal effect upon level of involvement. Thus, there is some evidence that these communication variables might be able to act indirectly upon themselves through level of involvement as well as through problem recognition.

The several variables which measure actual involvement have a small and inconsistent relationship with perceived level of involvement. The larger and significant Betas generally are positive, suggesting that actually involving people in situations might slightly increase their levels of communication behavior indirectly through perceived level of involvement.

Referent Criterion. Because of the same problems of goodness of fit and multicollinearity, the OLS estimates in Table 7 again seem preferable to the 2SLS estimates. Table 7 confirms the theoretical prediction that people will be most likely to have a referent when they perceive a problem and an involvement in a situation. The news exposure, knowledge, and information seeking variables provide some support for the idea that people who have information or knowledge convert that knowledge into a referent criterion. The relative size of the coefficients

indicates, however, that people do not convert information into an "attitude" unless problem recognition or perceived involvement motivates them to do something about the situation.

Table 7 also shows only a weak relationship between several standard cross-situational measures of attitude and presence of a referent criterion. This would suggest that standard attitudinal questions given to people are not very likely to measure an attitude which people actually hold.

Constraint Recognition. For the first time in Table 8 2SLS seems to provide a better fit than OLS, probably because only one endogenous variable—organization membership—was included in the equation. 2SLS was necessary only for the first environmental study, however, as organization membership was not measured in the other studies. Table 8 indicates that organization membership is the only consistent predictor of constraint recognition. As expected, Table 8 shows that people who join organizations to deal with a situation are less likely to perceive constraints in the situation. Low R^2s when that variable is not included in the equation suggest that constraint recognition is otherwise largely exogenous to the system and probably depends on actual situational constraints not measured in any of these studies.

News Exposure. For this variable, the OLS and 2SLS estimates are almost identical, because the instrumental variables for the only two endogenous variables included had low correlations with each other. Table 9 shows that news exposure correlates with readership of business publications and the newspaper financial page. For the low-relevance factor it also correlates with information processing, as those situations subsumed in that factor were closest to the items in the exposure index. Information seeking was not a strong predictor, indicating the economic news in the mass media is more often processed than sought out.

e same reason as in the news exposure equation, OLS and
most identical for the knowledge equation. The one exception
negative coefficient for information process which resulted
om 2SLS in the second environmental study. Table 10 shows a positive association of long-term knowledge with information processing, but not with information seeking. These coefficients seem to show that the knowledge items measured more often are processed than sought. The best predictors of knowledge, however, seem to be the education variables and income. This seems to suggest why a "knowledge gap" sometimes exists, an implication which will be explored in more detail below.

Organization Membership. In this case, 2SLS provides a substantially better fit than OLS. The Beta weights are similar for the two methods, although problem recognition drops in value and changes in sign in the 2SLS equation. The negative Beta for problem recognition in 2SLS, however, is too small for the sign change to be important. In spite of the better fit for 2SLS, multicollinearity still seems to have distorted this problem recognition coefficient.

In general, though, Table 11 supports the prediction that the four situational variables stimulate this one type of behavior, much as it stimulates communication behavior and the formation of attitudes. The major difference from the predictions of Equation 7, however, is that low constraint recognition, rather than high constraint recognition stimulates membership in organization.

CONCLUSIONS AND IMPLICATIONS

In this paper I have reformulated the multisystems theory of communication behavior as an interactive, simultaneous equation model rather than as a probabilistic model as it had been formulated before. I then subjected the model to a regression analysis using data from three studies. Statistical problems make it difficult to draw any strong conclusions about the accuracy of the model, although the OLS estimates of the parameters of the theory fit the conceptualization of the

theory almost perfectly. With a few exceptions these parameter estimates are also consistent across the four sets of data used.

Two-stage least squares, the regression method which econometricians prefer for simultaneous equation estimation, did not work well in this study because of low R_2s in the first stage of estimating instrumental variables and because of the multicollinearity which resulted. The ordinary least squares estimates must be treated with care because they are inconsistent and biased. Nevertheless, the OLS estimates nearly always were theoretically reasonable, consistent across the four data sets, and similar to the 2SLS estimates when multicollinearity was not a problem. Thus, it seems reasonable to conclude that the simultaneous equation model of the multisystems theory provides an accurate explanation of communication behavior.

By focusing upon the interaction of the four situational variables of the theory and upon the nonrecursive relationships of the communication variables to the situational variables, the model provides the professional communicator with an explanation of how he can, in principle, control the communication behavior of his audience. As discussed above, an increase in information processing provides the communicator his most likely point-of-entry into the system of equations. As the regression analysis showed, information processing more often is a random variable unaffected by the situational variables than is information seeking. Thus, a person might process information related to most situations. This information can increase problem recognition either directly or indirectly through an increase in perceived level of involvement. The result will be an indirect effect of information processing upon both information processing and seeking, Information seeking and processing can, in turn, further increase level of involvement and problem recognition, and so on.

Nevertheless, the data show that information processing provides a relatively weak point-of-entry into the system. In the first place, if these data are accurate,

the coefficients show a weak relationship between information processing and problem recognition and level of involvement. And, secondly, information processing is not a completely random variable; it is moderately determined by problem recognition. Thus, we must conclude that the members of a communicator's public exert more control over their own behavior than the communicator can. As uses and gratifications theorists would argue, the member of a public more often is an active communicator than a passive one. Yet, he is passive often enough for the communicator sometimes to be able to exert control to increase the frequency of communication behavior by members of his publics.

Publics will communicate most actively when they have a high perceived level of involvement in a situation. In that case, these data show that they nearly always recognize the situations as problematic and seek information to resolve the situation. An actively communicating public provides an easy audience for the communicator's message, as the previous probabilistic formulation of this theory showed. Obviously, the communicator does not need to intervene to stimulate public communication behavior in these high involvement situations.

When publics perceive a low level of involvement in a situation, however, not all will be passive audiences. Those with high problem recognition will still seek information and will be even more likely to pay attention to information which they do not seek--to process information--than those with low levels of problem recognition. The theory therefore, seems to provide an explanation of the conditions under which a "knowledge gap" will exist. When involvement is high most people will seek information and process information provided to them by others. Thus, no knowledge gap will exist (Donohue, Tichenor, and Olien, 1975). When involvement is low, however, a gap will exist, because as these data show, people with higher levels of problem recogntion, which is stimulated by education, will be more likely to process information, to seek information and accumulate knowledge than people with low levels of problem recognition (Tichenor, Donohue, and Olien, 1970).

Similarly, the model seems to provide an explanation of the conditions under which the media could be expected to have an agenda setting effect. Those conditions seem to be a combination of a low level of involvement and a high level of problem recognition. Low involvement seems necessary because people will seek information from many sources besides the media when involvement is high, and the media alone could not set the agenda unless they have a monopoly on information about the situation (McLeod, Becker and Byrnes, 1974). McCombs and Weaver (Weaver, 1977) found that exposure to media is necessary for agenda setting and that a "need for orientation" stimulates media exposure and agenda setting. Their operationalization of a "need for orientation" is similar to my operationalization of problem recognition. Thus, one can conclude that low involvement and high problem recognition provide the necessary conditions for agenda setting.

Ad discussed above, the simultaneous equation model indicates that a communicator may also enter the system by actually involving members of his publics in the situations about which he wishes to communicate. Teachers often try to involve students in the subject matter, environmentalists involve people with pollution, and public relations experts try to coopt publics into an involvement with the organization. The data reported here show this entry point to be a weak one, although still possible. In other words, actual involvement does not always lead to the perception of a strong connection with a situation. People may hunt or fish or hike, for example, and still not perceive a strong connection with environmental concerns.

In addition to communication behaviors, the model explains when people most likely will formulate a solution for a problematic situation (a referent criterion or "attitude"): under conditions of high involvement, low constraint recognition, and high problem recognition. (Grunig and Stamm (1979) also have obtained similar results.) Similarly, the results show that these same conditions, along with the

presence of a referent criterion, are generally present when a person actually does something (a movement or a behavior), although the data here are limited to the one movement of joining an organization. Thus, the four situational variables seem to be necessary conditions for what Carter (1973) has called "behavior," the thinking about, communicating about, and designing of a movement, as well as the actual movement itself.

FOOTNOTES

1. I would like to thank Richard Carter of the University of Washington School of Communications for first suggesting that I investigate the interactions of variables in my theory and Eric Uslaner of the University of Maryland Department of Government and Politics for teaching me methods of simultaneous equation estimation.

2. I am purposively using the concept of a public here rather than mass or audience because I believe the recipients of the messages provided by communication professionals can best be described as publics. See Grunig and Disbrow (1977), Grunig (1978a), and Grunig (1979b).

3. For further explication of the multisystems theory see Grunig (1978b) and Grunig (1979a). For support for the situationality of the theory, see Grunig and Disbrow (1977).

4. All computer analyses were conducted at the University of Maryland Computer Science Center, with the financial assistance of the Center. Analyses reported here were done with the Statistical Package for the Social Sciences (SPSS). Comparative analyses done with the Time Series Processor (TSP) package yielded results almost identical to those of SPSS. Results were used here, however, because TSP does not compute standardized Beta coefficients.

TABLE 1

R^2 of Endogenous Variables Regressed on Exogenous Variables in First Stage of 2SLS

	First Environmental Study	Second Environmental Study	First Economic Factors	Second Economic Factors
Problem Recognition	.29	.18	.24	.07
Level of Involvement	.23	.12	.17	.05
Constraint Recognition	.20	.13	.12	.04
Referent Criterion	.22	.10	.18	.06
Information Seeking	.08	.16	.14	.15
Information Processing	.19	.07	.18	.12
Organization Membership	.22	*	*	*
News Exposure	.40	.30	.23[a]	.23[a]
Knowledge	*	*	.38[a]	.38[a]

* Not included in study.

a Same for both factors.

TABLE 2

Intercorrelations of Original and Instrumental Endogenous Variables

	Problem Recognition	Level of Involvement	Constraint Recognition	Referent Criterion	Information Seeking	Information Processing	Knowledge	Exposure
(Top half of matrix includes correlations of instrumental variables, lower half of original variables)								
Problem Recognition	--	.82	-.82	.82	.70	.70	.39	.84
Level of Involvement	.56	--	-.78	.78	.68	.65	.22	.70
Constraint Recognition	-.40	-.40	--	-.79	-.74	-.68	-.82	-.26
Referent Criterion	.54	.56	-.39	--	.72	.75	.40	.72
Information Seeking	.37	.30	-.28	.31	--	.64	.38	.65
Information Processing	.37	.39	-.29	.44	.44	--	.65	.38
Knowledge	.20	.15	-.08	.22	.15	.28	--	.64
Exposure	.31	.28	-.18	.24	.18	.28	.27	--

TABLE 3

Simultaneous Equation Estimates for Information Seeking Equation

	First Environmental Study		Second Environmental Study		First Economic Factors		Second Economic Factors	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Endogenous Variables	(Standardized Beta Coefficients)							
Problem Recognition	.18*	-.27	.15	.01	.32**	-.01	.31**	.17*
Level of Involvement	.08	-.19	.12	.18	-.06	-.03	-.02	.12
Constraint Recognition	-.30**	-.19	-.23**	-.23	.08	-.03	-.26**	-.01
Referent Criterion	-.12	-.24	.05	-.05	-.10	.12	.09	-.06
Exogenous Variables								
Readership of Business Publications	-	-	-	-	.19**	.23**	.00	.01
Readership of Newspaper Financial Page	-	-	-	--	.01	.06	-.06	-.01
R_2	.15	.02	.19	.12	.23	.12	.22	.05
F	10.15**	0.87	12.46**	8.49**	11.81**	4.96**	10.75	1.96
Standard Error	10.78	11.62	13.16	13.68	0.76	0.82	0.76	0.84

* P< .01
** P< .05

TABLE 4

Simultaneous Equation Estimates for Information Processing Equation

	First Environmental Study		Second Environmental Study		First Economic Factors		Second Economic Factors	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Endogenous Variables	(Standardized Beta Coefficients)							
Problem Recognition	.16*	-.06	.10	.06	.14	.05	.24**	.12
Constraint Recognition	-.36**	-.30**	-.09	-.15	-.07	.02	-.06	-.04
Referent Criterion	.05	.00	.04	-.05	.31**	.19	.17*	-.01
Exogenous Variables								
Readership of Business Publications[a]	-	-	-	-	.07	.08	-.05	-.04
Readership of Newspaper Financial Page	-	-	-	-	.09	.10	.14	.03
R^2	.22	.07	.03	.02	.25	.11	.13	.02
F	21.13	5.74**	2.49*	1.73	15.38**	5.81**	6.85**	.76
Standard Error	11.45	12.49	27.68	27.82	0.72	0.79	0.77	0.82

* P< .05
** P< .01

TABLE 5

Simultaneous Equation Estimates for Problem Recognition Equation

	First Environmental Study		Second Environmental Study		First Economic Factors		Second Economic Factors	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(Standardized Beta Coefficients)							
Endogenous Variables								
Level of Involvement	.28**	.29*	.51**	.34*	.42**	.22	.39**	.12
Constraint Recognition	-.07	.08	-.13*	.25	-.13*	-.19	.02	-.06
Information Processing	.17*	.21	.03	-.04	.08	.03	.11	.10
Information Seeking	.11	.00	.10	.17	.25**	.04	.26**	.01
Exogenous Variables								
Education	.35**	.33*	.01	.13	-	-	-	-
Grade Point Average	-	-	-	-	.06	.05	-.07	-.06
Parent Education	-	-	-	-	-.05	-.08	-.07	-.08
White Race	-.07	-.09	.12*	.01	.04	.04	-.07	-.12
Income	.02	-.02	.05	.06	-	-	-	-
R^2	.41	.28	.43	.16	.44	.20	.32	.04
F	21.68**	12.39**	23.48**	5.62**	24.78**	7.98**	14.97**	1.27
Standard Error	1.12	1.23	2.44	2.98	0.69	0.82	0.66	0.78

* $P < .05$
** $P < .01$

TABLE 6

Simultaneous Equation Estimates for Level of Involvement Equation

	First Environmental Study		Second Environmental Study		First Economic Factors		Second Economic Factors	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Endogenous Variables	(Standardized Beta Coefficients)							
Problem Recognition	.31**	.40	.40**	.21	.32**	.21	.38**	-.51
Constraint Recognition	-.30**	-.37	-.01	-.04	-.14*	-.04	-.03	.30*
Referent Criterion	-.03	-.19	.33*	-.05	.31**	.08	.11	.36
Information Processing	-.08	-.19	.05	.07	.11	.09	.19**	.08
Information Seeking	.11	.13	.06	.06	-.07	-.02	-.08	.18
Exogenous Variables								
Age	-.03	-.07	.01	.09	.09	.07	.01	.41
Hiking	.06	-.08	.10	.14	-	-	-	-
Swimming	-.03	-.11	-	-	-	-	-	-
Camping	.11	.07	-.04	-.08	-	-	-	-
Commuting	.05	.00	-	-	-	-	-	-
Hunting & Fishing	.12*	.12	-	-	-	-	-	-
Hunting	-	-	-.03	-.04	-	-	-	-
Fishing	-	-	.00	.04	-	-	-	-
Business/ Economic Courses			-	-	-.02	-.04	.02	.14
Business Major			-	-	.06	.09	.00	-.32
Public Relations Major			-	-	.12*	.14	-.04	-.05
Stock Ownership			-	-	-.06	-.07	-.09	.06
R^2	.37	.23	.49	.11	.46	.15	.26	.04
F	11.73**	5.78*	20.04**	2.67*	19.19**	3.78**	7.82**	0.86
Standard Error	1.00	1.11	2.76	3.63	0.66	0.84	0.73	0.83

* $P < .05$

** $P < .01$

TABLE 7

Simultaneous Equation Estimates for Referent Criterion Equation

	First Environmental Study		Second Environmental Study		First Economic Factors		Second Economic Factors	
Endogenous Variables	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(Standardized Beta Coefficients)							
Problem Recognition	.31**	.19	.30**	.07	.31**	.11	.30**	.05
Level of Involvement	.10	-.03	.35**	.18	.35**	.16	.14*	-.16
Information Seeking	.00	-.03	.09	.09	.05	.06	.14*	.12
News Exposure	.10	.24*	.14*	.12	.02	.09	.01	.02
Knowledge	-	-	-	-	.12*	.04	.01	.00
Exogenous Variables								
Environmentalist Attitude	-	-	.01	.03	-	-	-	-
Willingness to Pay Taxes	-	-	-.17**	-.20**	-	-	-	-
Pro-Business Attitude	-	-	-	-	-.10*	-.08	.07	.08
Pro-Government Attitude	-	-	-	-	.01	.03	-.10	-.14
Liberal Philosophy	-	-	-	-	.00	.05	.04	.13
Republican Party	-	-	-	-	.02	.02	-.02	.06
R^2	.19	.15	.42	.10	.42	.14	.22	.04
F	12.20**	9.82**	26.56**	4.06**	19.09**	4.18**	7.62**	1.05
Standard Error	1.53	1.56	2.66	3.34	0.69	0.84	0.71	0.79

* $P < .05$
** $P < .01$

TABLE 8

Simultaneous Equation Estimates for Constraint Recognition Equation

	First Environmental Study		Second Environmental Study	First Economic Factors	Second Economic Factors
	OLS	2SLS	OLS	OLS	OLS
Endogenous Variables	(Standardized Beta Coefficients)				
Organization Membership	-.30**	-.50**	--	--	--
Exogenous Variables					
Income	-.07	.10	-.06	--	--
Male Sex	.09	.22*	-.04	-.11	-.03
Age	.06	.03	.19**	-.11	-.06
R^2	.10	.18	.05	.02	.01
F	6.78**	12.36**	3.48**	2.76	0.48
Standard Error	1.63	1.56	3.18	0.89	0.85

* P .05
** P .01

TABLE 9

Simultaneous Equation Estimates for Exposure to Economic News Equation

	First Factors		Second Factors	
	OLS	2SLS	OLS	2SLS
Endogenous Variables	(Standardized Beta Coefficients)			
Information Seeking	.03	.04	.00	-.10
Information Processing	.15*	.09	.01	-.08
Exogenous Variables				
Readership of Business Publication	.12	.09	.15*	.14*
Readership of Newspaper Financial Page	.25**	.23**	.29**	.29**
R^2	.16	.14	.14	.16
F	11.20	9.64**	9.27	10.83
Standard Error	1.03	1.04	1.04	1.03

* P<.05
** P<.01

TABLE 10

Simultaneous Equation Estimate for Knowledge Equation

	First Environmental Study		Second Environmental Study		First Economic Factors		Second Economic Factors	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
Endogenous Variables	(Standardized Beta Coefficients)							
Information Seeking	.02	.01	.06	.03	.03	-.05	-.05	-.18**
Information Processing	.16*	.15	.0	-.21*	.17*	.08	.11*	.12*
News Exposure	-	-	-	-	.10	.09	.14*	.01
Exogenous Variables								
Education	.47*	.50*	.33*	.43*	-	-	-	-
Grade Point Average	-	-	-	-	.24**	.24**	.25**	.30**
Parent Education	-	-	-	-	.01	.02	.02	-.02
Business/Economics Courses	-	-	-	-	.47*	.47*	.49**	.57**
Income	.17**	.12	.15*	.24**	-	-	-	-
R^2	.36	.35	.19	.21	.38	.34	.36	.36
F	32.02**	30.56**	13.00**	13.32**	23.12**	19.37**	21.10**	21.23
Standard Error	1.23	1.24	1.91	1.89	1.13	1.17	1.15	1.15

* P<.05
** P<.01

TABLE 11

Simultaneous Equation Estimates for Membership in Environmental Organizations

	OLS	2SLS
Endogenous Variables	(Standardized Beta Coefficiants)	
Problem Recognition	.19*	-.06
Level of Involvement	.02	.10
Constraint Recognition	-.18*	-.11
Referent Criterion	.09	.35**
R^2	.14	.22
F	9.28	14.90**
Standard Error	0.74	0.71

* P<.05
** P<.01

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